How NMFS and NOS use JPSS data

Cara Wilson

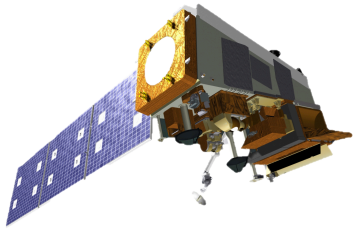
Environmental Research Division
NOAA/NMFS/SWFSC
99 Pacific St, Suite 255A, Monterey CA

Presented at the 2017 NOAA Satellite Conference, July 17-20, 2017

How NMFS and NOS use JPSS data

NMFS: National Marine Fisheries Service
NOS: National Ocean Service

JPSS Instruments



ATMS: Advanced Technology Microwave Sounder

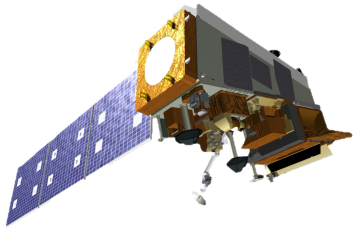
CERES: Clouds and the Earth's Radiant Energy System

CrIS: Cross-track Infrared Sounder

OMPS: Ozone Mapping and Profiler Suite

VIIRS: Visible Infrared Imaging Radiometer Suite

JPSS Instruments



ATMS: Advanced Technology Microwave Sounder

CERES: Clouds and the Earth's Radiant Energy System

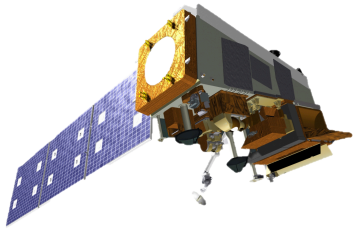
CrIS: Cross-track Infrared Sounder

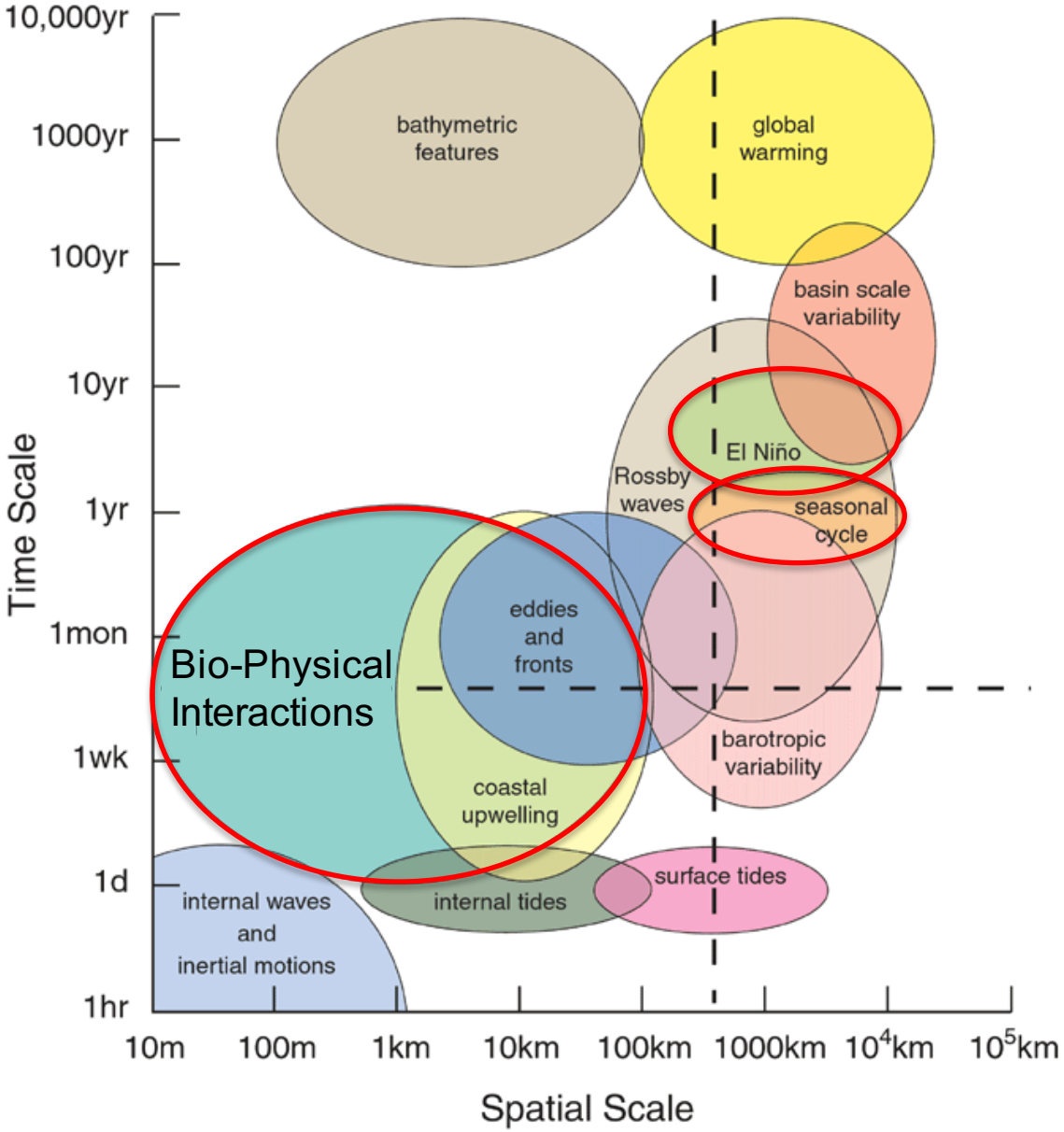
OMPS: Ozone Mapping and Profiler Suite

VIIRS: Visible Infrared Imaging Radiometer Suite

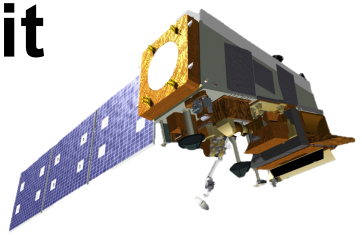
Only the VIIRS instrument makes oceanographic measurements, i.e, surface chlorophyll and sea-surface temperature, that are useful to NMFS and NOS

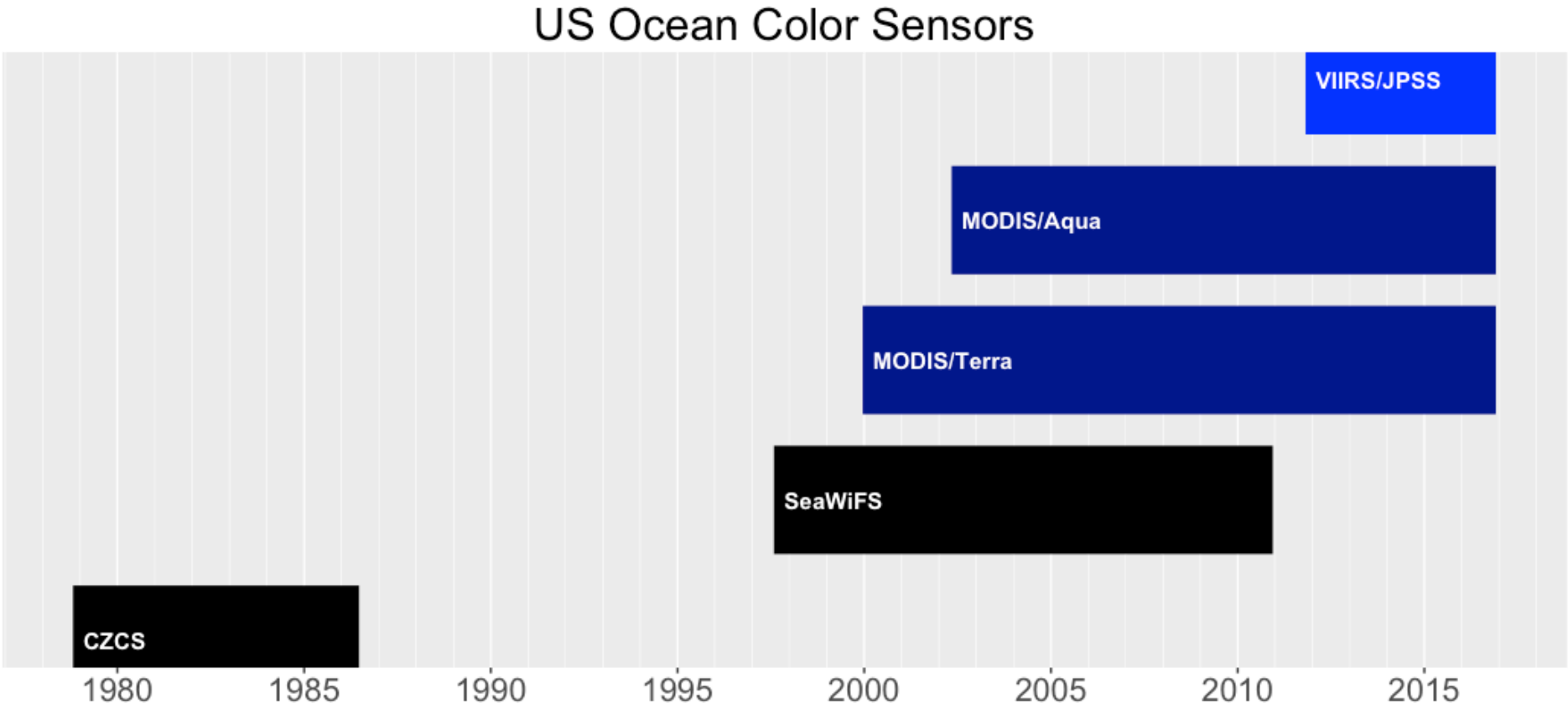
Relevant Timescales

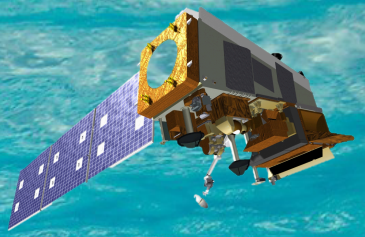




The biggest value of VIIRS is that it is part of a longer timeseries



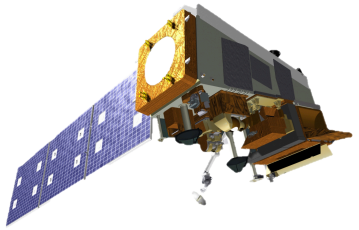




Examples of VIIRS usage within NOS and NMFS

(mostly from NOAA satellite course participants)

VIIRS data on ERDDAP



coastwatch.pfeg.noaa.gov/erddap

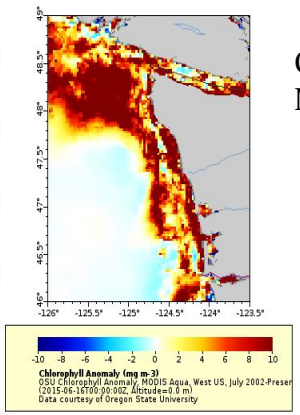
The results of the search for viirs chl

42 matching datasets, with the most relevant ones listed first.

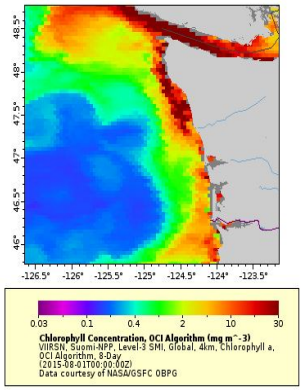
Grid DAP Data	Sub-set	Table DAP Data	Make A Graph	WMS	Source Data Files	Acces-sible	Title
data			graph	M	files	public	Chlorophyll a, North Pacific, NOAA VIIRS, 750m resolution (1 Day Composite)
data			graph	M	files	public	Chlorophyll a, North Pacific, NOAA VIIRS, 750m resolution (3 Day Composite)
data			graph	M	files	public	Chlorophyll a, North Pacific, NOAA VIIRS, 750m resolution (8 Day Composite)
data			graph	M	files	public	Chlorophyll a, North Pacific, NOAA VIIRS, 750m resolution (Monthly Composite)
data			graph	M		public	OSU Chlorophyll Bloom Product, VIIRS Suomi-NPP, Northwest US, 2012-present
data			graph	M	files	public	VIIRSN, Suomi-NPP, Level-3 SMI, NASA, Global, 4km, Chlorophyll a, OCI Algorithm, 8-Day
data			graph	M	files	public	VIIRSN, Suomi-NPP, Level-3 SMI, NASA, Global, 4km, Chlorophyll a, OCI Algorithm, Daily
data			graph	M	files	public	VIIRSN, Suomi-NPP, Level-3 SMI, NASA, Global, 4km, Chlorophyll a, OCI Algorithm, Monthly
data			graph	M		public	NOAA CoastWatch, VIIRSN, Suomi-NPP, Level 3 SMI, Chlorophyll, Global, Daily
data			graph	M	files	public	VIIRSN, Suomi-NPP, Level-3 SMI, NASA, Global, 4km, Reflectance at 671 nm, Monthly
data			graph	M	files	public	VIIRSN, Suomi-NPP, Level-3 SMI, NASA, Global, 4km, Reflectance at 671 nm, 8-Day
data			graph	M	files	public	VIIRSN, Suomi-NPP, Level-3 SMI, NASA, Global, 4km, Reflectance at 671 nm, Daily
data			graph	M	files	public	VIIRSN, Suomi-NPP, Level-3 SMI, NASA, Global, 4km, K490, 8-Day
data			graph	M	files	public	VIIRSN, Suomi-NPP, Level-3 SMI, NASA, Global, 4km, K490, Daily
data			graph	M	files	public	VIIRSN, Suomi-NPP, Level-3 SMI, NASA, Global, 4km, K490, Monthly
data			graph	M	files	public	VIIRSN, Suomi-NPP, Level-3 SMI, NASA, Global, 4km, POC, 8-Day
data			graph	M	files	public	VIIRSN, Suomi-NPP, Level-3 SMI, NASA, Global, 4km, POC, Daily
data			graph	M	files	public	VIIRSN, Suomi-NPP, Level-3 SMI, NASA, Global, 4km, POC, Monthly

Nancy Wright 2015
Olympic Coast National Marine Sanctuary

Oceanographic Characterization of Washington State Outer Coast

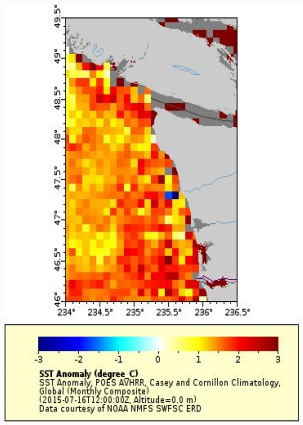


HABs
OSU **Chl** Anomaly
MODIS Aqua West, Daily



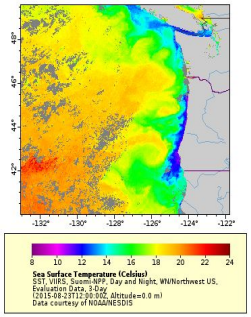
VIIRSN, Suomi-NPP, Global, 4km, **Chlorophyll**, OCI Algorithm, 8-Day

Ocean Color



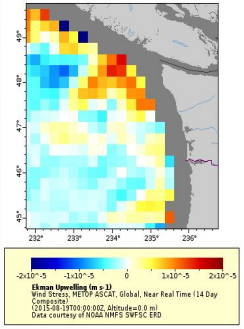
SST Anomaly, POES AVHRR, Casey and Cornillon Climatology, Global (Monthly Composite)

BLOB



Non-Anomaly, **SST**, VIIRS, Suomi-NPP, Northwest US, 3-Day

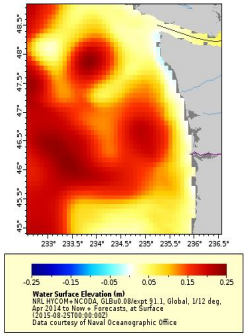
SST



Upwelling

Wind Stress, METOP ASCAT, Global, Near Real Time (14 Day Composite)

Scatterometry



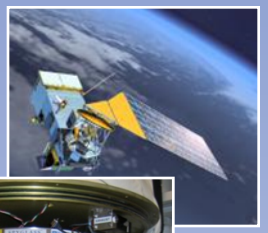
Currents, Gyres

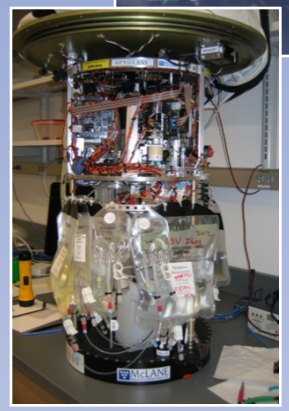
NRL HYCOM+NCODA, Apr 2014 to Now, Forecasts, at Surface

Modeled SSHA

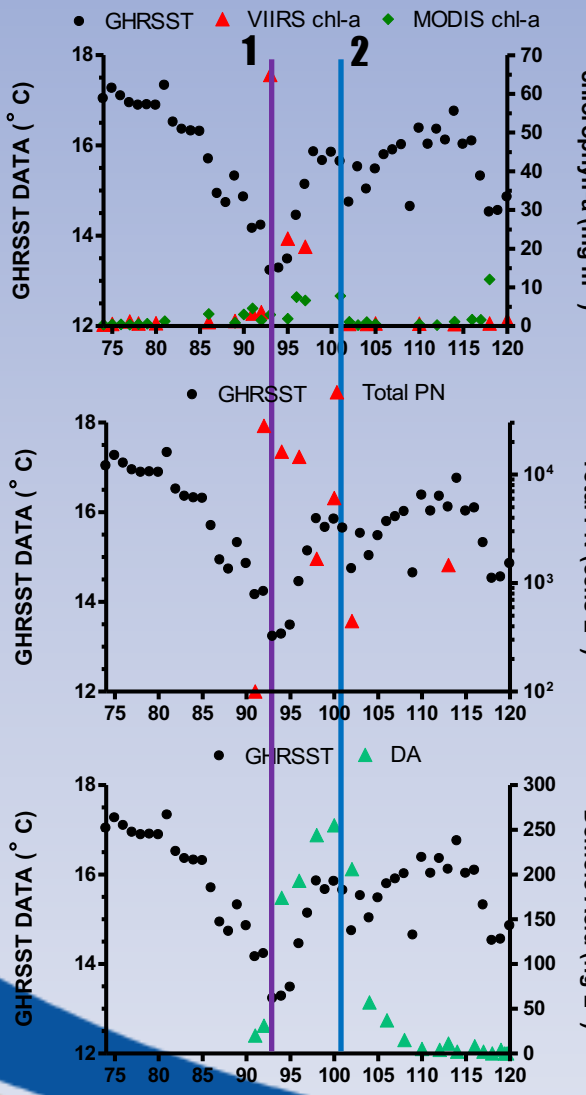
Satellite & Subsurface Remote Sensing: potential influence of an upwelling event on HAB dynamics in San Pedro Bay, CA

Gregory J. Doucette, National Ocean Service

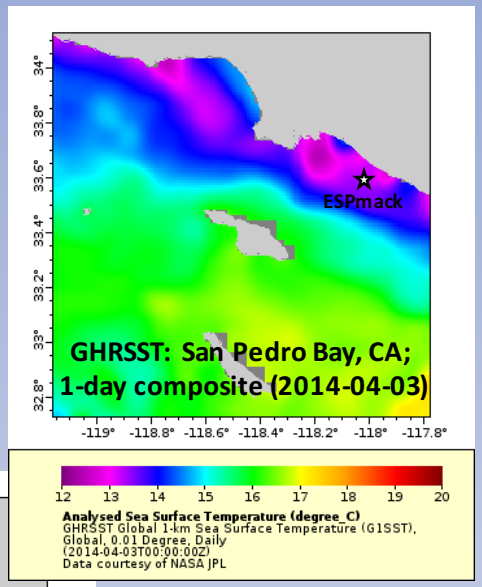


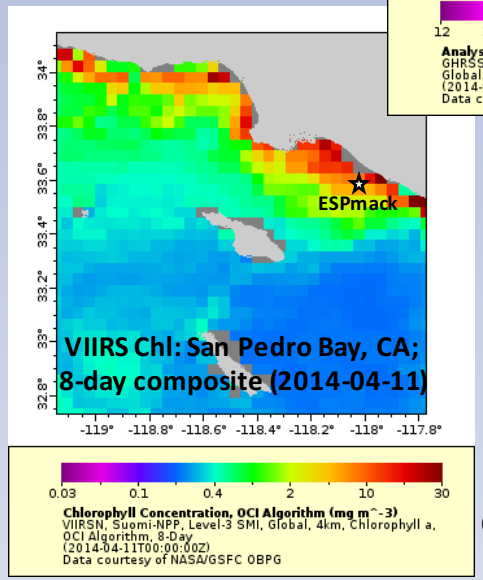


Environmental Sample Processor (ESPmack): subsurface HAB & toxin detection at mooring (☆)



Purple line (1): peak of upwelling event revealed by GHRSST data, corresponding to the appearance of cells in HAB genus, *Pseudo-nitzschia* (PN), at ESPmack mooring





Blue line (2): peak of domoic acid (DA) concentration following upwelling relaxation & corresponding to high VIIRS chl signature & continued presence of *Pseudo-nitzschia* cells at ESPmack mooring

Observations

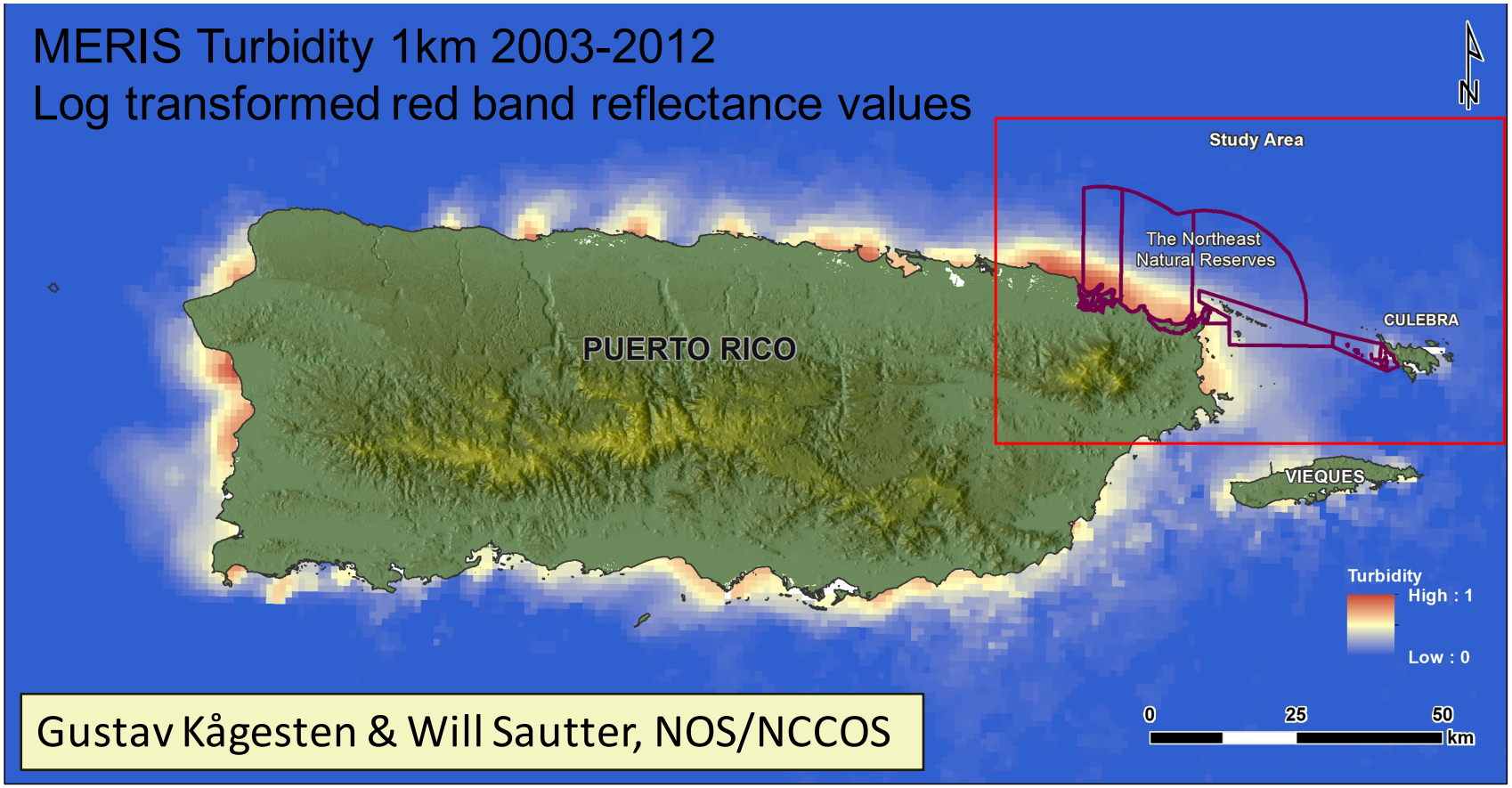
- GHRSST data revealed strong upwelling event at ESP mooring preceding toxic HAB
- VIIRS chlorophyll data consistent with PN HAB associated with upwelling event
- HAB DA toxicity peaked during upwelling relaxation period

NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE
coastalscience.noaa.gov

August 2015

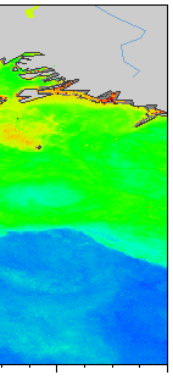
MPA Development

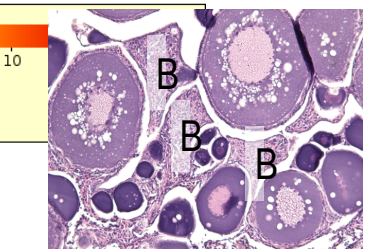
Biogeographical assessment of new MPA (marine protected area) in Puerto Rico



- High resolution (750m) ocean color and SST data from VIIRS will be extremely useful
- Need data in a format that is easy to pull into ArcGIS

Temporal variability in rockfish reproductive parameters in the Gulf of Alaska



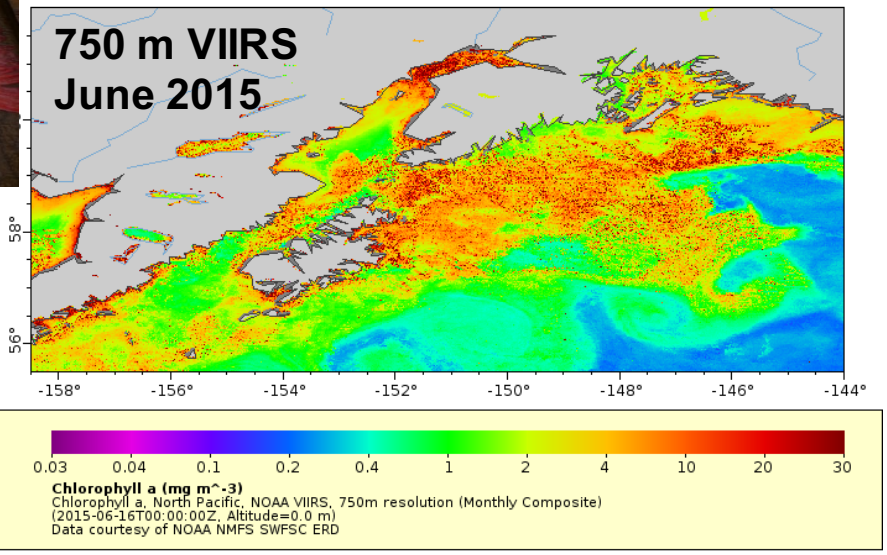


A histological section of a non-spawning adult shortraker rockfish. There is evidence of a prior spawning (B) but no current development.

A histological section of a spawning adult shortraker rockfish. The embryos within this section were at the eyed stage of development.

Objective

Examine temporal variability in reproductive parameters (maturity, fecundity, reproductive success, and the strength of maternal effects) to see how these changes may be related to environmental variability including sea surface temperature and primary productivity.

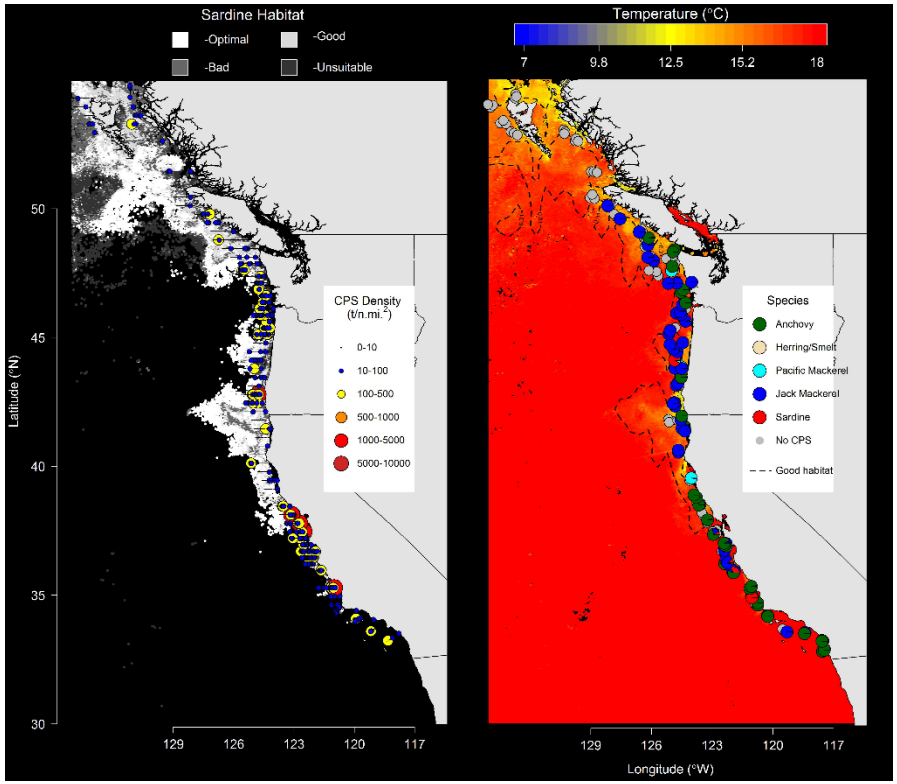


750 m VIIRS
June 2016

These charts show the variability in chlorophyll a concentrations on the same day during two different years (2015 and 2016).

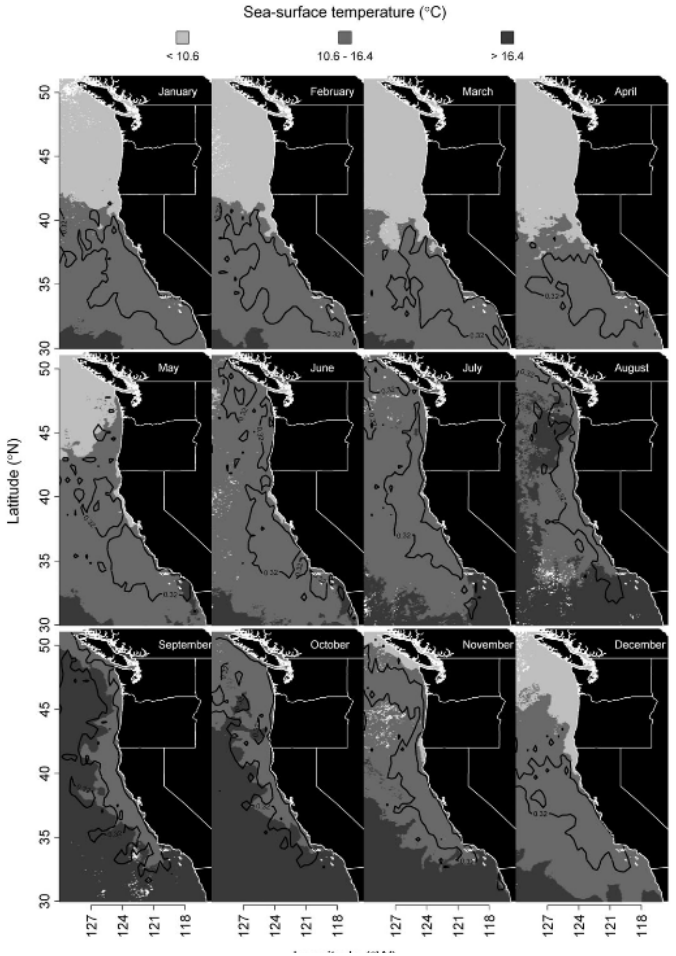
Sardine Habitat Mapping

Juan Pablo Zwolinski, SWFSC



Above: Survey data results overlaid on a static, northern stock pacific sardine habitat map.
Future iterations of this product will consist of stitched high-temporal and spatial resolution VIIRS SST and chlorophyll-a data to better match satellite data and CPS survey observations.

http://icesjms.oxfordjournals.org/content/68/5/867.abstract



Below: ERDDAP SST is currently being used to separate sardine landings from 2 different stocks to improve stock assessments. This effort will continue into the future.

http://icesjms.oxfordjournals.org/content/71/2/328.short

Salmon survival in 2011 – what happened?

Brian Burke
Fish Ecology Division
NWFSC, NOAA Fisheries

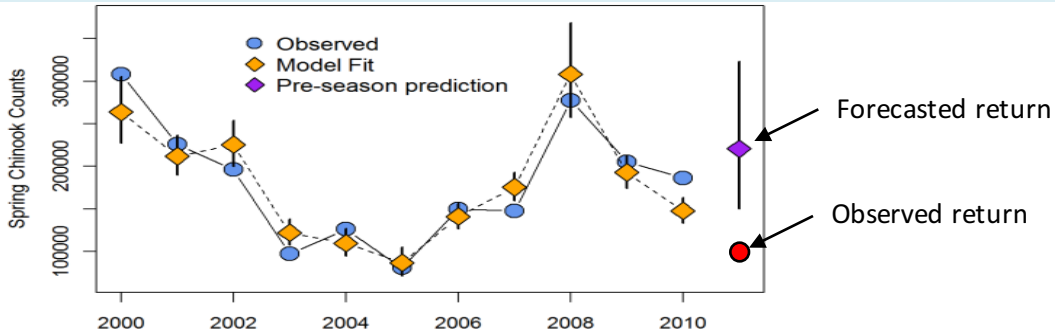


Figure 1. Observed and fitted adult spring Chinook salmon returns, with the forecasted and observed returns for fish entering the ocean in 2011.

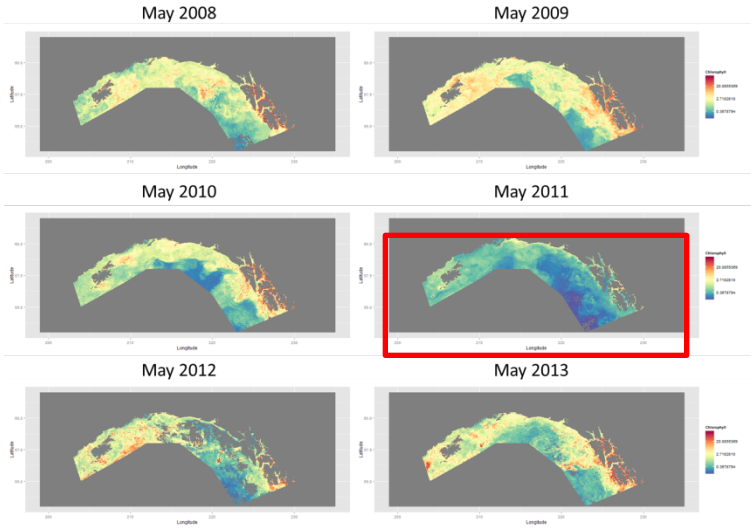


Figure 2. Chlorophyll concentration in May (2008-2013) in coastal Gulf of Alaska.

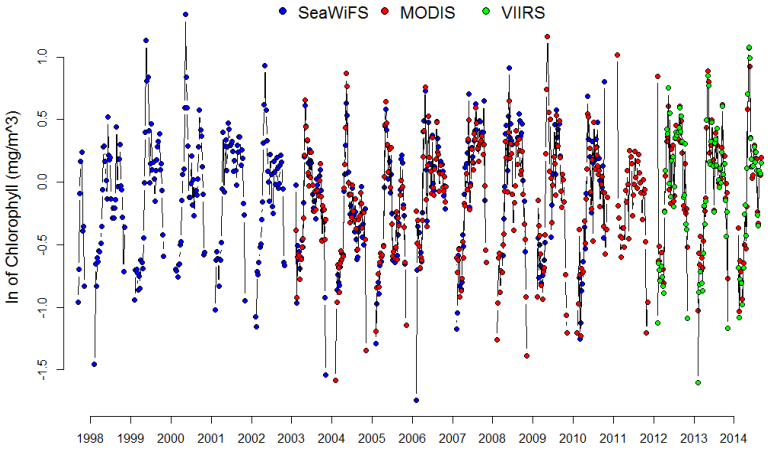


Figure 3. Time series of 8-day composite chlorophyll concentrations.

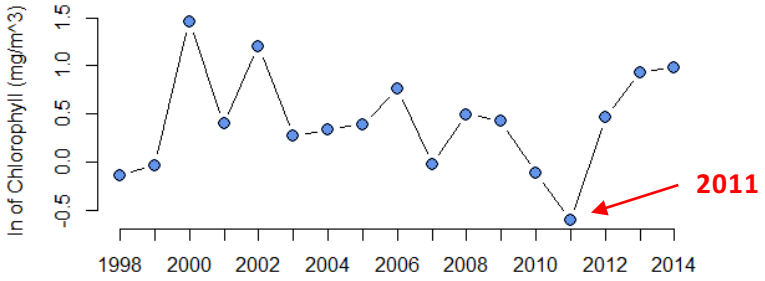
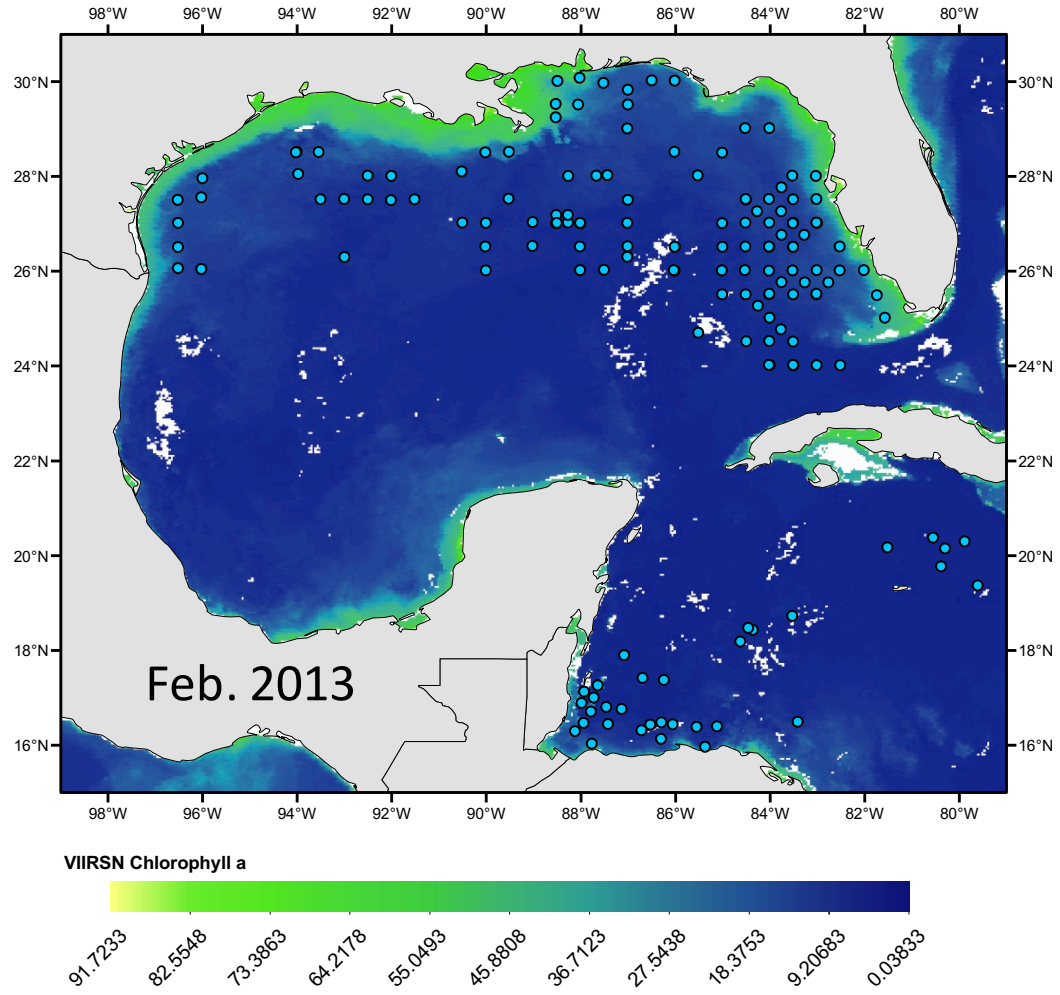


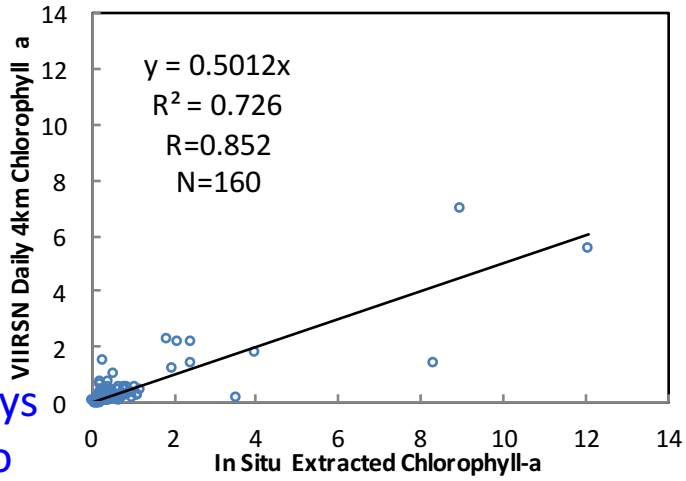
Figure 4. Time series of average April-May chlorophyll concentrations in coastal Gulf of Alaska. The lowest value (2011) suggests that low productivity could have negatively influenced salmon survival that year.

Comparison of In-situ Chl-a and VIIRS Chl-a

David S. Hanisko and John Quinlan, NOAA/NMFS/SEFSC



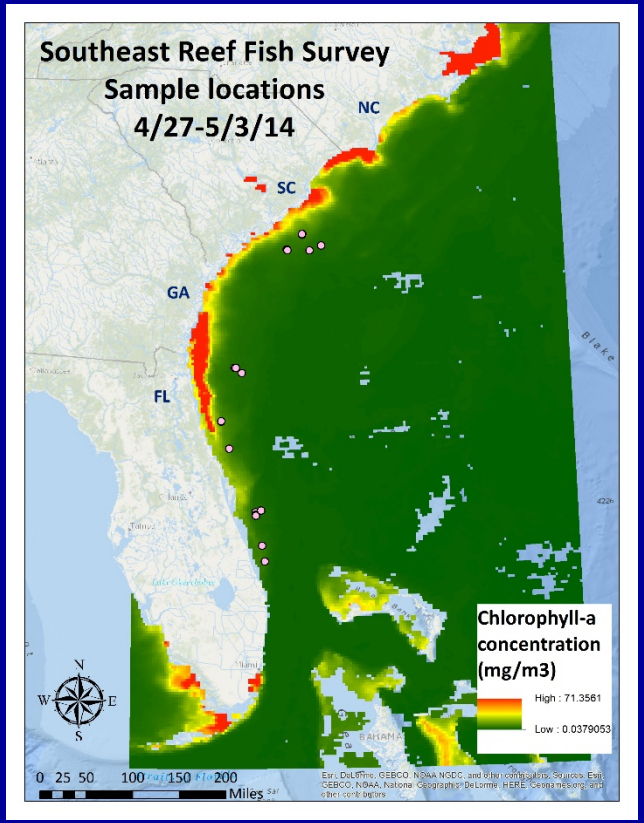
In-situ chlorophyll (chl-a) data was collected during Spring and Fall SEAMAP (Southeast Area Monitoring and Assessment Program) Plankton Surveys conducted by the NMFS Southeast Fisheries Science Center. Surface chl-a was extracted from triplicate 200 ml seawater subsamples at each station using a modified Welshmeyer method and was reported as the average value of the subsamples. 562 observations of in-situ chl-a from the 2012 and 2013 surveys coincided with the operational status of the VIIRS sensor from the Suomi National Polar-Orbiting Partnership (NPP) Mission. Daily observations from 160 in-situ chl-a samples were matched in time and space with VIIRS daily sensor data. In-situ and VIIRS chl-a data were highly correlated (r=0.852). The majority of samples available for comparisons were primarily from open ocean observations with low chl-a values and very few observations from areas of high primary productivity.

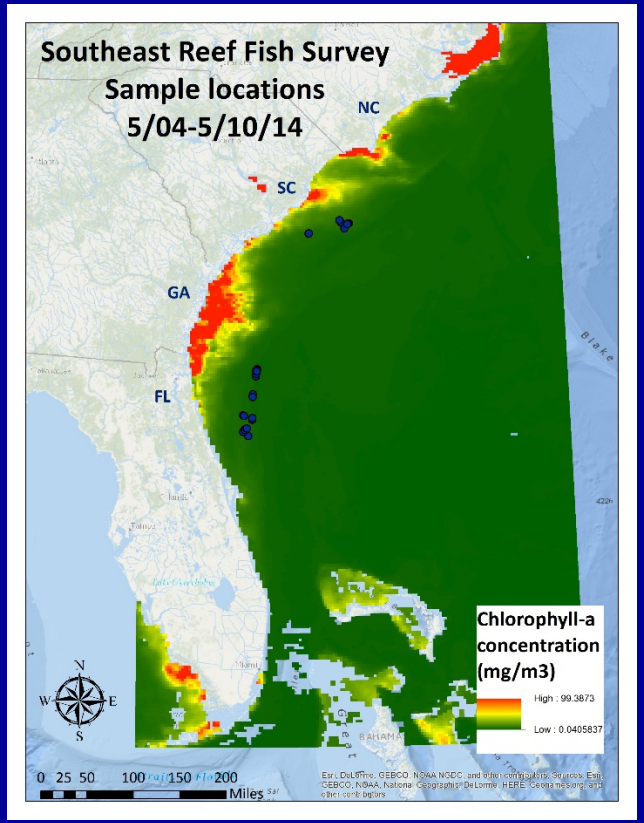


NMFS/SEFSC collects chl-a data as part of plankton surveys every spring and fall. They are willing to give their data to the VIIRS cal/val effort if additional data is needed.

Is the distribution of Atlantic sharks correlated with ocean productivity (chl-a)?

Satellite data: VIIRSN, Suomi-NPP, Level-3 SMI, Global, 4km, Chlorophyll-a, OCI Algorithm, 8-Day

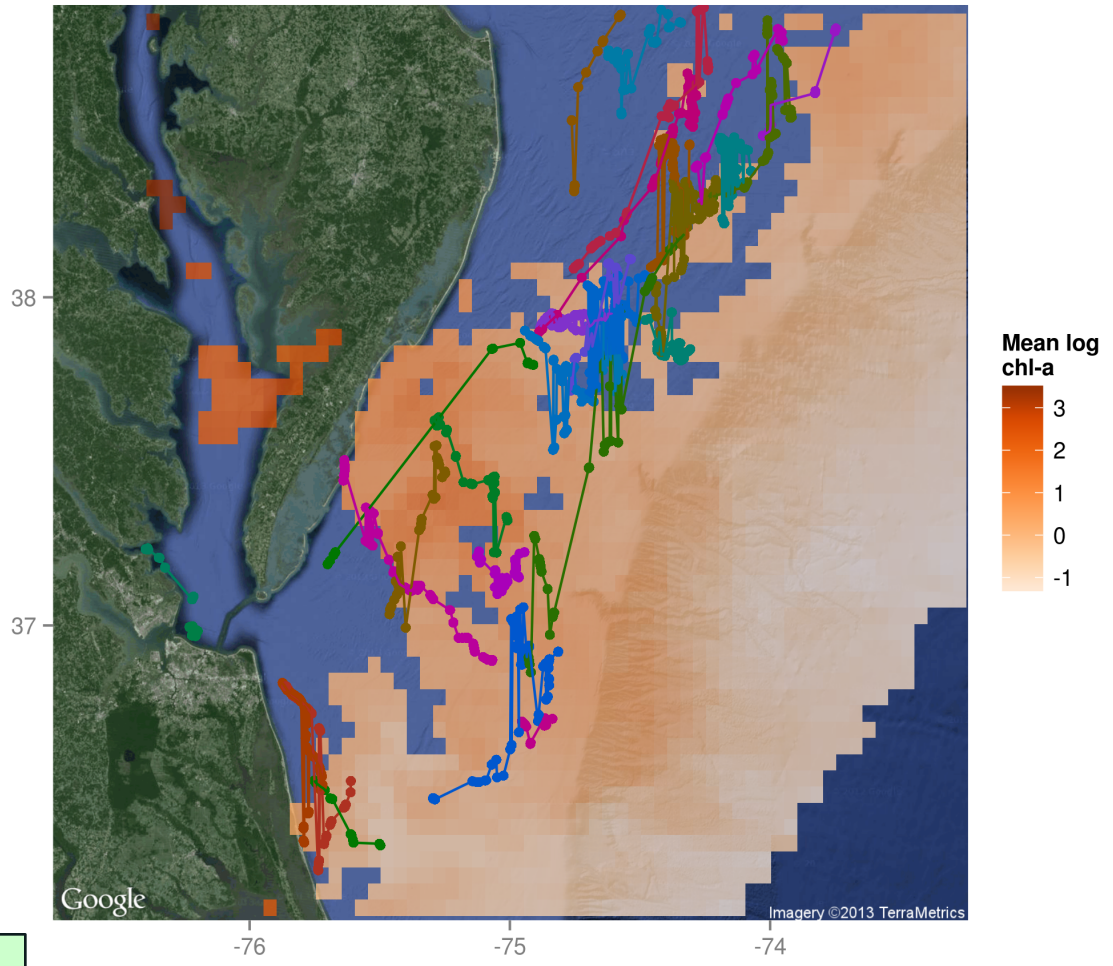




RC Muñoz, NMFS/SEFSC

Is chlorophyll-a correlated with loggerhead sea turtle distribution?

- VIIRS chlorophyll-a 8-day average for 06-01-2013
- Tracks of tagged loggerhead sea turtles for the same week



Melissa Warden, NMFS/NEFSC

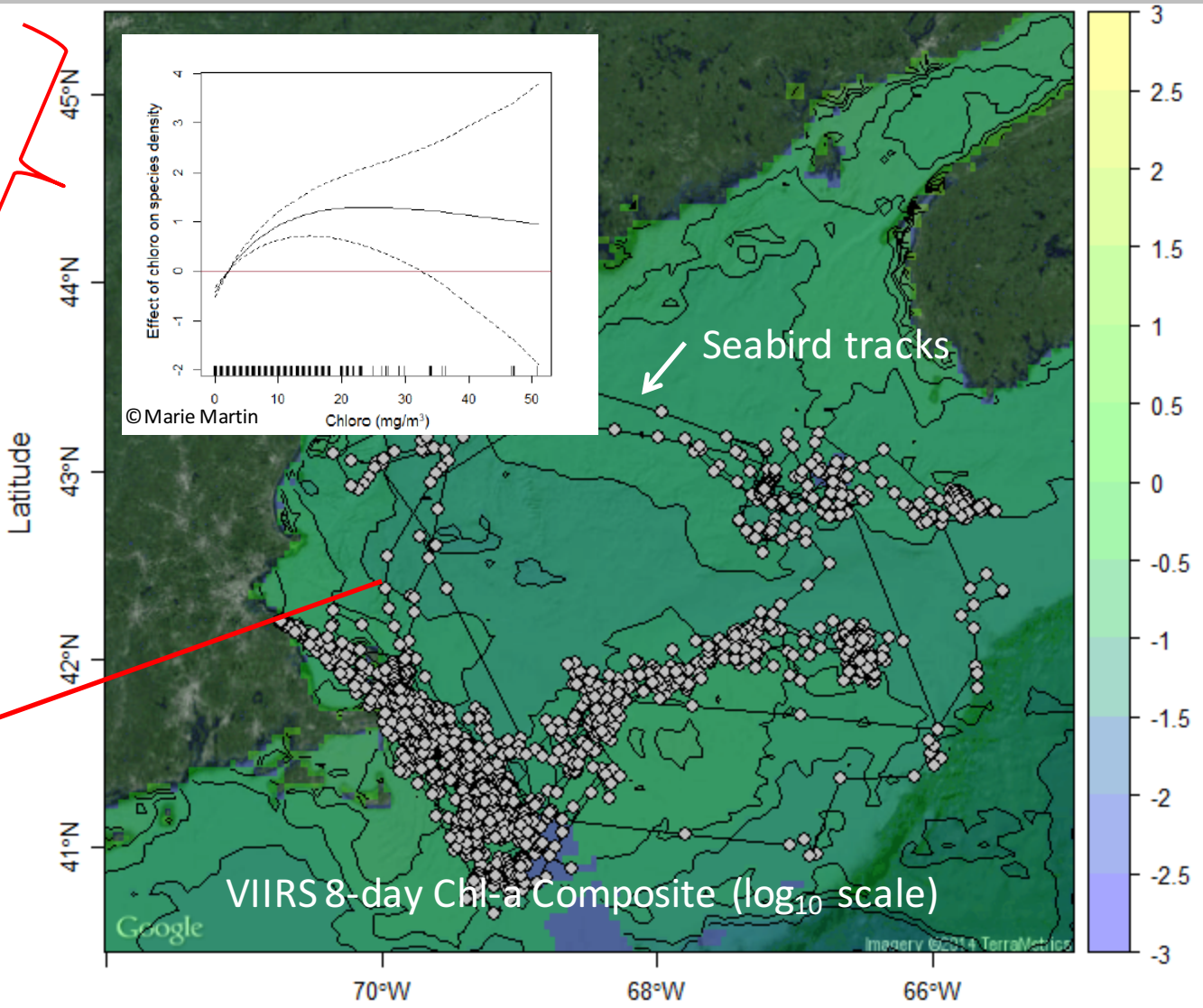
Is the distribution of seabirds correlated with ocean productivity (chl-a)?

Joshua Hatch, NOAA/NEFSC, Resource Evaluation and Assessment Division

Chlorophyll-a has been shown to influence seabird densities (Martin 2013)

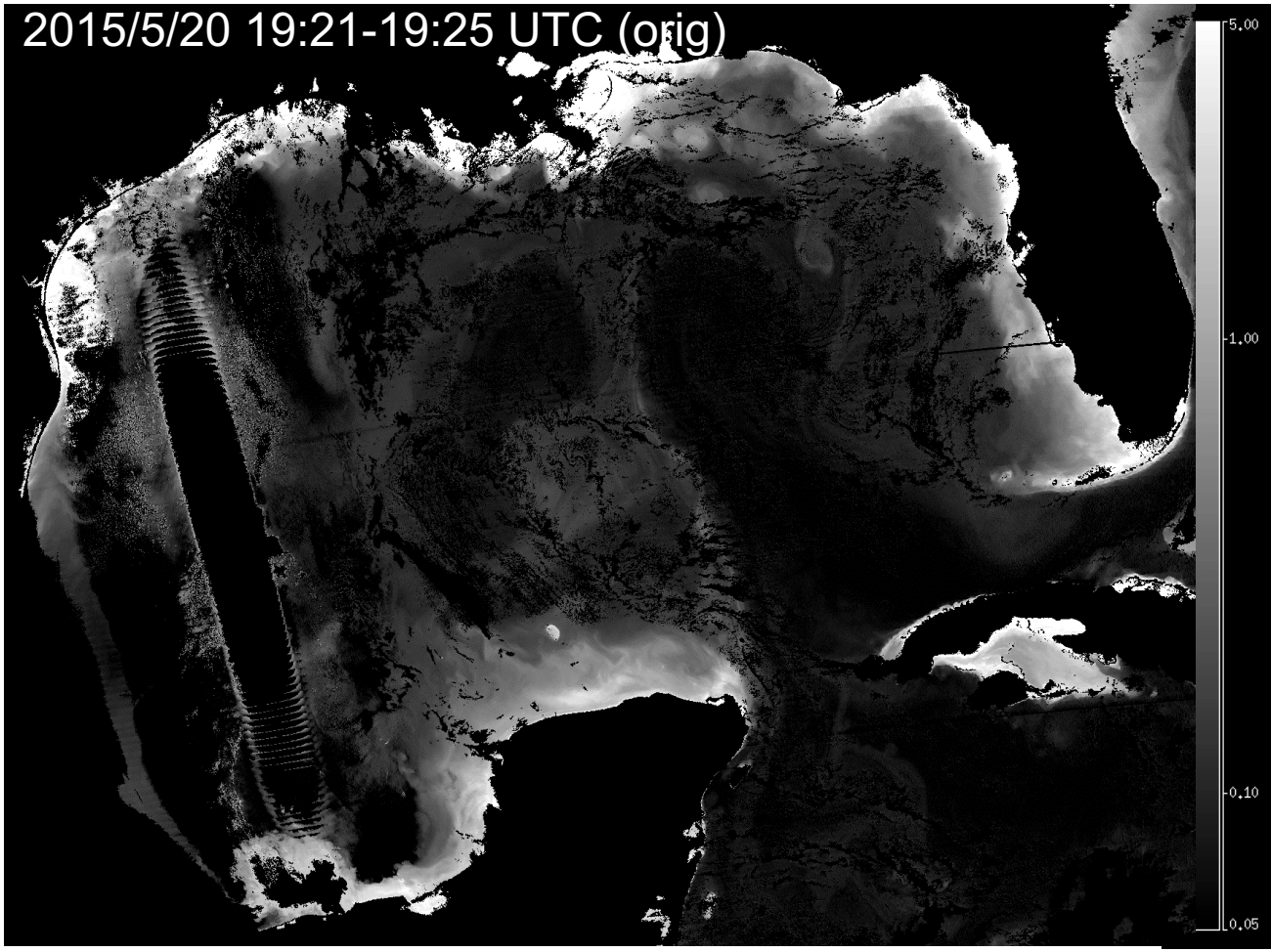
Several species of seabirds can smell dimethyl sulfide (DMS), a compound released by phytoplankton during zooplankton grazing, which may correlate with Chl-a

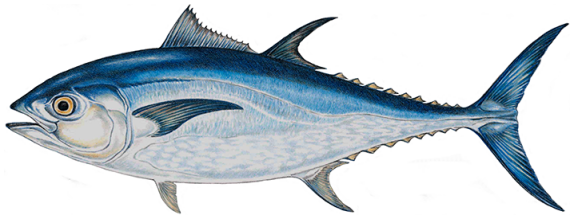
Chl-a may then be a useful metric to assess seabird presence, as they seek out productive areas to forage



NRT Cruise support

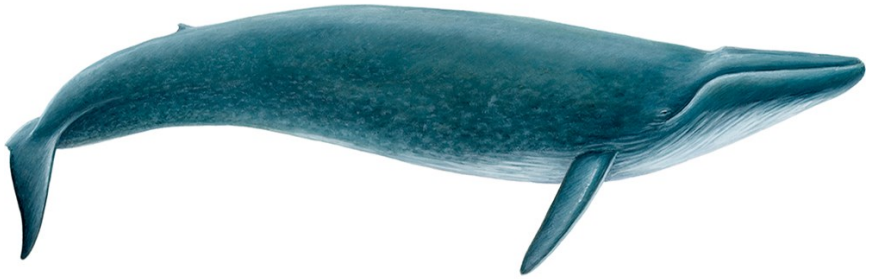
- VIIRS chl image generated by NESDIS in support of a SEFSC survey cruise looking for bluefin tuna larvae.
- Images are used to position stations to cover frontal features, small and mesoscale oceanographic features, and to ensure as many different water masses as possible are sampled.
- They requested the images in gray scale.





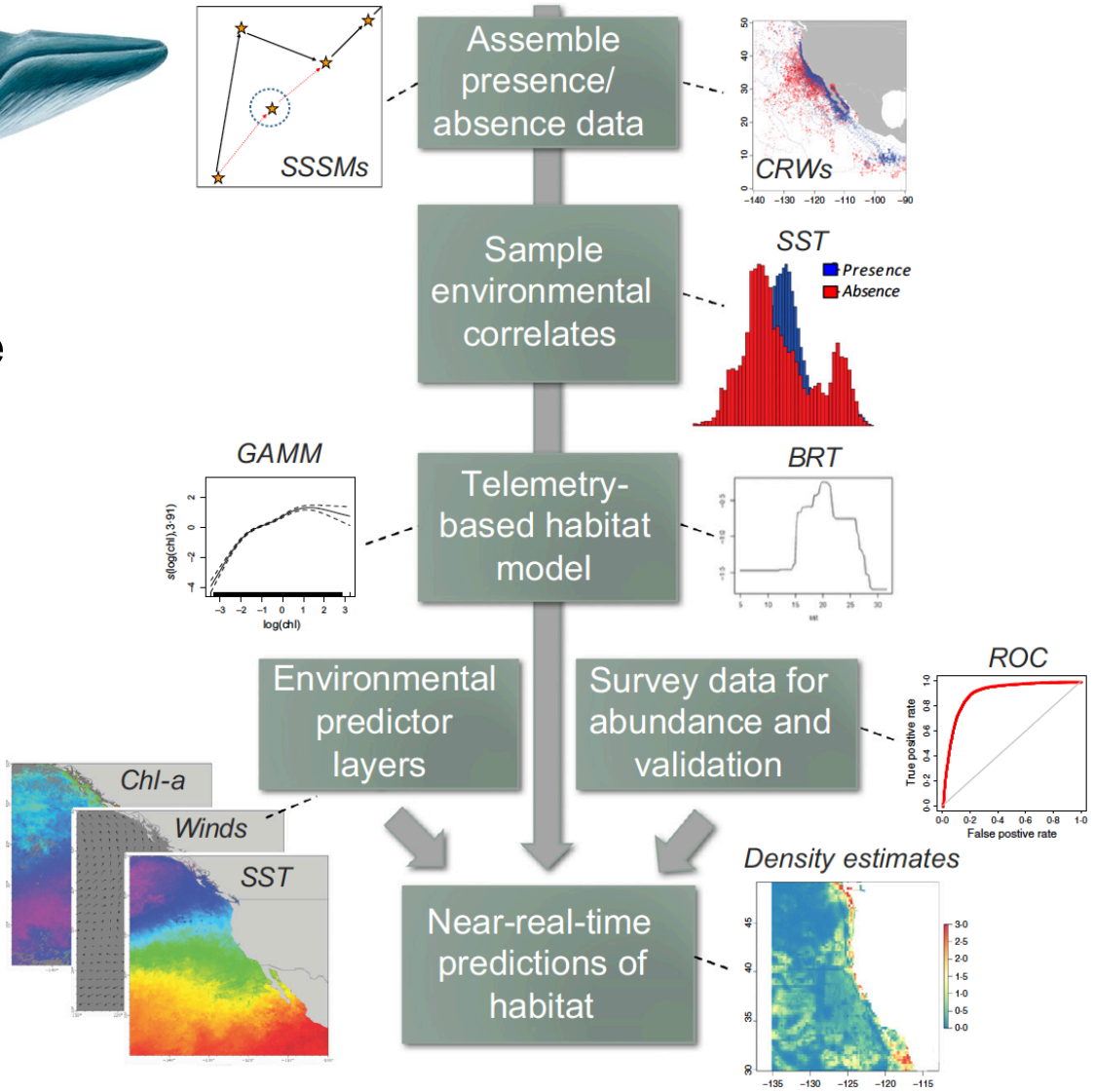
John Lamkin, NOAA/NMFS/SEFSC

WhaleWatch



Predicting blue whale whale locations to minimize ship strikes, a key factor limiting their population recovery (they are classified as a threatened species).

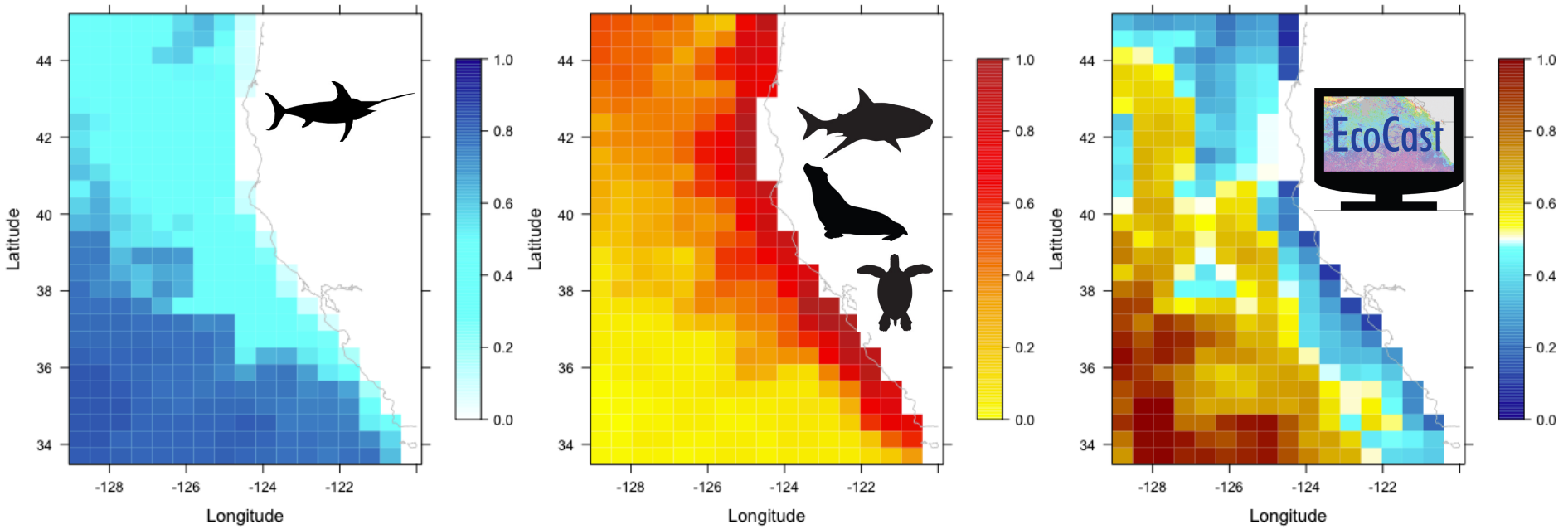
Hazen et al., 2016
J. Appl. Ecology



EcoCast

Predicting fishery bycatch for management

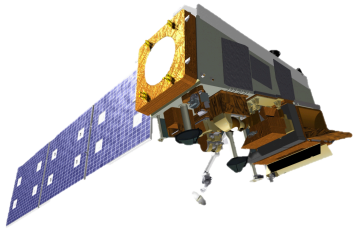
Predicted catch + **Predicted bycatch** ➔ **EcoCast**



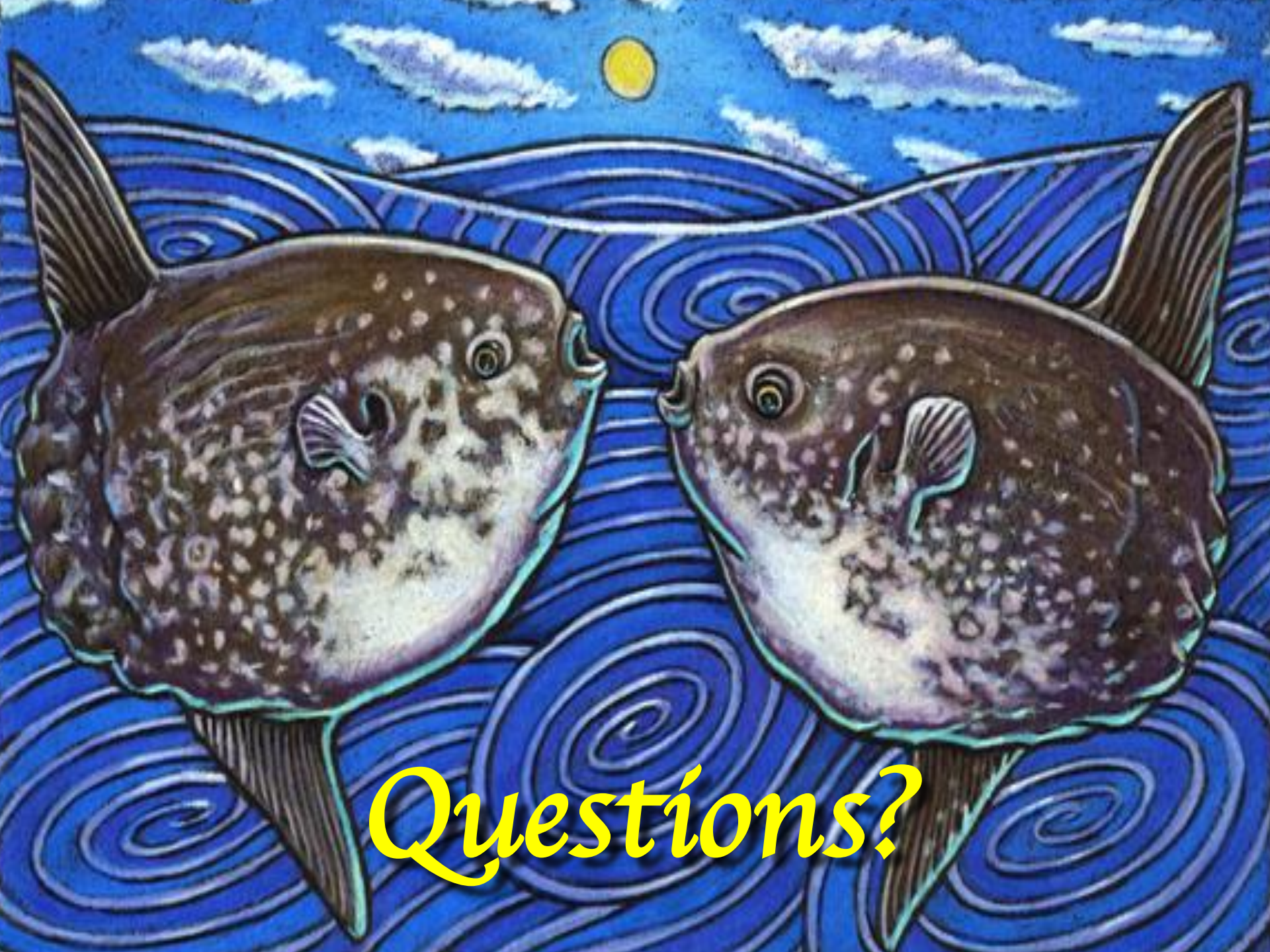
Using remotely sensed products, these surfaces can be predicted in near-real time for use by managers and fishers. A collaborative project between ODU and SWFSC, funded by NASA.

Elliott Hazen et al., NMFS/SWFSC

Take Home Points



- Within NMFS and NOS VIIRS ocean color data is used in a variety of different applications, many of which are not a NRT or 24/7 usage. Examples include:
  - Understanding HAB dynamics (NOS)
  - Characterizing sanctuaries and MPA (NOS)
  - Optimizing assessment surveys (NMFS)
  - Improving Stock Assessments (NMFS)
  - Characterizing Animal Habitat (NMFS)
  - Dynamic Ocean Management (NMFS)
- The biggest value of VIIRS is that it is part of a longer time-series of satellite chlorophyll measurements that extends back to 1997.
- Long-term climate-quality VIIRS ocean color data are needed for NMFS and NOS applications.


Questions?